

A Systematic Review and Framework for Teachers' Digital Leadership Research

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Abstract

Since the COVID-19 epidemic triggered a drastic shift in the teaching paradigm, many colleges and universities have accelerated the pace of digital transformation. Although the current research on digital leadership in education has made some progress, there is still a lack of research focusing on college teachers, especially in the construction of theoretical frameworks and summarization of practice mechanisms. Therefore, it is necessary to systematically review the existing research results, clarify the core components of teachers' digital leadership, and propose a future-oriented research path and practice framework. This study adopts a systematic literature review method, following the PRISMA process, to screen key publications on teachers' digital leadership in higher education between 2020 and 2025. The review extracts the theoretical foundations, research themes, and major findings from the selected literature. Based on this, this paper constructs a comprehensive framework for analyzing "teachers' digital leadership", covering its definition, functioning mechanism and influence path. The framework not only provides theoretical support for future empirical research, but also provides reference for policy formulation and practice innovation in the construction of teacher digital leadership in universities, filling the key gaps in the existing literature.

Keywords: Education, Teacher, Digital Leadership, Systematic Literature Review, Theoretical Framework

Introduction

In recent years, as global digitization continues to accelerate, digital leadership has emerged as a key focus in academic research. This trend has become even more pronounced in the

wake of the COVID-19 pandemic (Iqbal et al., 2025). In this context, the role of teachers is undergoing profound changes. They are not only the transmitters of knowledge, but are gradually becoming guides and collaborators in the digital environment. This change is not only related to the effectiveness of teaching practice, but also directly affects the overall resilience and future adaptability of the education system. As, Xu et al. (2025) pointed out, enhancing teachers' ICT literacy is closely related to their professional development, and the guiding role of educational leaders is particularly important in this process. Today, school leaders need to not only continue to learn and update their digital skills themselves, but also help teachers and staff to continue to grow in order to adapt to this rapidly changing digital society. In addition, the digital literacy of students is becoming increasingly important, and schools must build a strong foundation for their future learning and lives (Karakose et al., 2022). The challenges and opportunities brought about by the deep-seated changes in the education system by digital technologies make “digital leadership” an extension of the technology management skills of educational administrators and teachers. Therefore, Strengthening the study of “digital leadership” is of great significance in promoting educational equity, the quality of educational management, and the improvement of teachers' teaching quality and sustainable development.

As technology evolves and the educational landscape continues to change, more and more educational participants, especially frontline teachers, also need to develop some digital leadership skills (Karakose et al., 2024). However, most of the current research on digital leadership in the education system focuses on principals or school administrators, with a notable lack of attention to the teacher population (Baxter et al., 2025). At the same time, against the backdrop of the rapid development of emerging technologies such as artificial intelligence, big data in education, online platforms, and blended learning, the effective use of these technologies in daily teaching and learning remains a major challenge. Educational leaders must not only enable teachers to become users of technology, but also help them build multi-competency collaborative teams to promote the true integration of technology into teaching and learning (Chang et al., 2022).

Especially in higher education, the effective implementation of digital leadership is particularly urgent. However, there are still deficiencies in theoretical maturity and empirical research, and systematic sorting and framework construction still need to be strengthened (Jameson et al., 2022). While there has been some research pointing to the positive role of principals in driving digital transformation in schools (Karakose et al., 2021), teachers themselves, as knowledge disseminators and curriculum leaders, should not be neglected in their digital leadership skills. As Jameson et al., (2022) also pointed out that research on teacher leadership is still scarce, and that teachers are often viewed simply as “tool users,” ignoring their potential impact on organizational culture and school development. The potential influence of teachers in organizational culture and school development has been overlooked. It is worth noting that in recent years, research has also begun to explore the central role of teachers in digital change. For example, Chang et al., (2022) found that in the face of unexpected crises and the lack of clear policies and technical support, university teachers often need to take the initiative to organize teaching resources and coordinate work schedules to ensure the continuity of teaching and learning. Luo and Wang, (2024) further suggested that teachers in the application of smart teaching systems not only needed to design the content, but also needed to know how to integrate the system

functions and optimize them based on user feedback. Srivastava et al. (2023) suggested that teachers' "digital agility" was the foundation of their leadership role, which combined a combination of technical knowledge, decision-making judgment, and flexibility. When practicing digital leadership, teachers also encountered problems such as technological anxiety, lack of systemic support, and rigid organizational structures, which affect the full development of their abilities (Fernández et al., 2024).

Based on the above background, this study will integrate the current research results on digital leadership of college teachers, sort out the focus and shortcomings of existing research, and construct a theoretical framework and practice model for higher education through a systematic literature review. This study will not only provide theoretical support for teacher training and digital literacy construction, but also provide decision-making basis for education policy makers and university administrators, which will help to promote the development of the education system in the direction of smarter, more efficient and fairer. This study will be organized around the following three questions:

RQ1: What are the definitions of digital leadership and its constitutive dimensions in different studies?

RQ2: What are the current focuses in the study of digital leadership among university teachers?

RQ3: What theoretical models are currently being used to explain teachers' leadership behaviors during digital transformation?

Research Methodology

To enhance the systematic and logical nature of the literature review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework was adopted as a theoretical tool for analyzing and organizing the literature. The framework consists of seven core building blocks: purpose of the study (P), scope of the study (S), methodological path (A), literature support (L), integrative analysis (S), in-depth analysis (A), and research recommendations (R). It aims to identify and analyze core theories, research trends, and key influences on teachers' digital leadership.

This study focuses on peer-reviewed scholarly articles and review papers related to "digital leadership for teachers" from 2020-2025, covering secondary and tertiary education, focusing on the intersection of "digital leadership", "e-leadership", and "education". The research focuses on the intersection of "digital leadership", "e-leadership" and "education". In order to further identify the research hotspots and trends, keyword clustering analysis and co-occurrence visualization were carried out with the help of the CiteSpace tool to sort out the distribution and evolution trajectory of research topics.

Table 1

Search Strategy and Inclusion Criteria

Project	Contents
Database	Web of Science, Scopus, Google Scholar
Search Time	2020 – 2025
Language Restriction	any
Keyword Strategy	"e-leadership" OR "digital leadership" AND "education"
Boolean logic	AND, OR
Inclusion Criteria	Teacher or educational background; reference to digital leadership; type of literature as article or literature review
Exclusion Criteria	No educational relevance; non-academic sources; duplicate literature
Final number of literature included	30 (all conditions met and inclusion confirmed by summary reading)

Results

RQ1: What are the definitions of digital leadership and its constitutive dimensions in different studies?

Digital Leadership is generally regarded as an extension of traditional leadership in the digital environment, and its concept combines e-leadership, technology leadership, virtual leadership, and leadership 4.0 and other related fields. Although these concepts have different names, their common core lies in enabling organizational change through information technology and redefining the way leaders interact with their teams by means of remote collaboration, platform governance, and cultural restructuring (Neyisci & Sari, 2023). There is currently no consensus among academics on the definition of "digital leadership", mainly because the concept is still evolving and being reconfigured (Karakose et al., 2022). Several studies showed that different scholars tend to use the terms technological leadership, e-leadership, and virtual leadership interchangeably to describe the technological competencies, organizational competencies, and cultural steering competencies that leaders need in the digital environment (Karakose et al., 2024).

In the field of language education, for example, the deep integration of artificial intelligence has led to a new form of 'teacher digital leadership' practice, which is often intertwined with the concept of e-leadership in some studies (Hoang, 2025a). With the accelerated digitization of the education system, the term 'teacher digital leadership' has begun to emerge as a separate and well-defined term in research. Initially, the concept was primarily used to describe the strategic role of top school administrators in driving digital transformation; however, with the increasing role of teachers in instructional decision-making, classroom organization, and technology integration, digital leadership at the teacher level become a hot topic of research. Karakose et al., (2022) defined teacher digital leadership as the comprehensive ability of teachers to lead instructional reform, build organizational culture and promote educational innovation in the context of digital technology. This ability not only includes basic technical operations, but also involves deeper leadership functions such as strategic thinking, cultural construction and organizational coordination.

In the field of higher education, faculty digital leadership is also seen as an important driver for the construction of digital culture in education. For example, one study understood this as a set of core attributes and competencies of educational leaders in driving the formation of digital culture in schools. These leaders typically possess strong technological literacy and

organizational alignment, and are able to guide community members to embrace and effectively use digital tools to support learning and teaching objectives (Ghamrawi & Tamim, 2023). Yuting et al., (2025) pointed out that in higher education environments, digital leaders not only needed to possess basic technological knowledge, but also e-skills and online leadership practices to create a technology-driven learning ecosystem, while Hoang (2025) also focused his research on the integration of AI technologies and proposed the concept of “teacher e-leadership”. He proposed the concept of “teacher e-leadership,” which emphasizes that teachers should not merely act as users of technology, but should instead guide, support, and continuously innovate in virtual teaching environments as active leaders. Ören & Atik, (2025) further validated the dimensions of teachers' digital leadership based on the DigifueHR 2.0 scale. They noted that a teacher with digital leadership should be able to effectively adopt technology in complex educational environments, facilitate collaborative learning, promote cultural sharing, and ultimately enhance the adaptability and instructional effectiveness of the school organization.

In addition, some studies emphasized the role of teachers as cultural leaders, with Chang et al., (2022) and Ehlers (2020) pointing out that teachers are not only users of pedagogical tools, but also “re-constructors” of educational culture. They led the formation of a future-oriented educational ecosystem through the deep integration of technology with curriculum and organizational structure.

Combined with the above views, teachers' digital leadership can be understood as a multidimensional leadership structure, covering the guidance of teaching reform, the integration of emerging technologies, the synergy of teaching teams, and the construction of educational culture. This competency not only requires teachers to master technology, but also emphasizes their strategic guidance role in the learning process and their responsibility to lead in constructing a sustainable teaching culture.

RQ2: What are the current focuses in the study of digital leadership among university teachers?

Current Research Hotspots

A total of 12 keyword clusters were identified through CiteSpace visualization and analysis, with “academic leadership (#0)”, “digital leadership (#1)” and “digital transformation (#2)” constitute the core knowledge structure of this research area. Their frequent appearance, large number of nodes and strong connection in the literature network indicate their continued popularity and theoretical dominance in the research of digital leadership among college teachers.

In terms of time evolution, the research focus has gradually expanded from the early focus on “education technology” and “leadership modeling” to broader application scenarios such as “higher education”, “healthcare”, and “artificial intelligence”. Healthcare, ‘Artificial Intelligence’ and other broader application scenarios. Especially since 2022, keywords such as “innovation,” “technology implementation,” “teacher digital competencies,” and “distance learning” have begun to proliferate. “ have begun to proliferate, highlighting the significant impact of the COVID-19 epidemic on research in this area. At the same time, humanistic topics such as “teacher well-being” and “student engagement” are receiving increasing attention,

showing that the research perspective has gradually shifted from the macro-organizational level to the micro-individual experience.

Overall, the direction of research has gradually shifted from “how to cope with sudden changes” to “how to promote deep-seated changes”, and “teacher digital leadership” has become an important keyword throughout the transformation of the education system. Teachers' digital leadership has become an important keyword throughout the whole process of education system transformation. Under this trend, teachers are not only users of digital tools, but also core leaders in promoting education reform and digital governance.

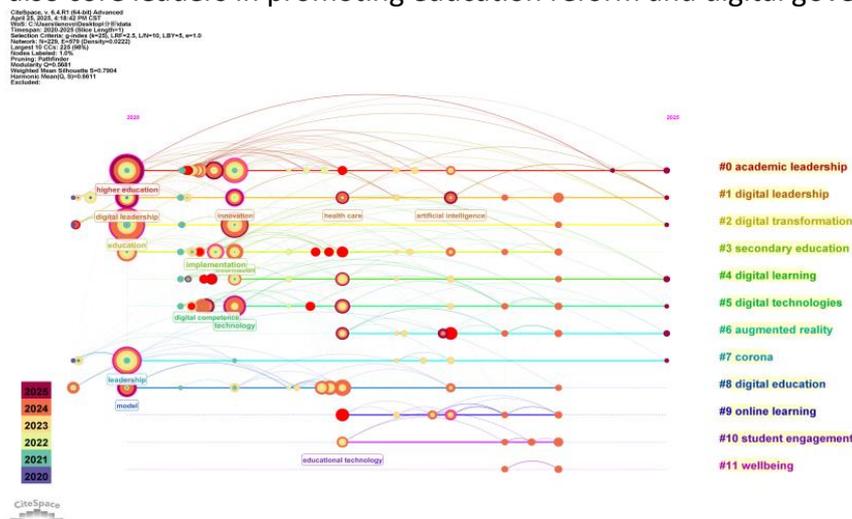


Figure 1. Timeline Visualization of Knowledge Evolution in Teachers' Digital Leadership Research (CiteSpace Analysis)

Major Research Themes

A) teacher digital leadership response in crisis situations (e.g., COVID-19)

The use of digital technology in education was already in its infancy before the outbreak, but the global disruption in education has significantly increased the emphasis on teacher digital leadership. In this context, student demand for high-quality online education continues to grow, and school leaders are becoming more open to experimenting with new tools and approaches (Nhedzi & Azionya, 2025).

In this process, teachers have become digital leaders rather than just instructional implementers, and Antonopoulou et al., (2025), in a study of Greek elementary school teachers, found that teachers with transformational leadership traits were more likely to proactively adopt digital tools, design online content, and assist their colleagues in adapting to new platforms. This type of spontaneous digital leadership behavior is typical of teachers' digital leadership, which does not hinge on administrative positions, but rather on teachers' sensitive insights and positive responses to environmental changes. Jameson et al., (2022) further point out that teachers often act as “temporary institutional navigators” in crisis situations, building bridges between digital platforms and pedagogical needs through their own actions in the context of ambiguous policies and weak institutional support.

Although teachers were actively involved in the digital transformation of their schools during the epidemic, their leadership behaviors remained marginalized in most organizations. Currently, most schools do not provide teachers with explicit decision-making spaces or

institutional support, making their leadership role difficult to institutionalize and often manifesting itself as “implicit leadership” that is difficult to sustain (Neyisci & Sari, 2023). In the context of the rapidly advancing digitalization of education, teachers' identities are gradually changing from users of technological tools to agents of pedagogical innovation and organizational change (Hoang, 2025b). A growing body of research emphasizes that teachers play a central role in technology integration, curriculum transformation, and culture building, and are a key force in driving digital change within the education system (Xu et al., 2025; Lozano-Díaz et al., 2024). (Hoang, 2025b) further noted that teachers, when integrating AI tools, not only demonstrate strong technological adaptability, but also the ability to cross techno-cultural boundaries and reconfigure teaching practices.

In addition, teachers' digital leadership is not only reflected in the adaptation of their own teaching styles, but also significantly influences the acceptance and use of digital platforms by their surrounding colleagues and students. As AlAjmi (2022) pointed out, the ability to translate technology into instructional programs is a key variable in determining the success or failure of technology integration. In the context of the full-scale implementation of distance learning, teachers have begun to take on the roles of collaborative facilitators and knowledge-sharers, and (Chang et al., 2022) pointed out that some university teachers have taken the initiative to organize online learning communities, write manuals, and share teaching resources to help their colleagues improve their adaptability to the new platforms. This kind of “empowering support” and “technology advocacy” is an important manifestation of teachers' digital leadership.

Research on this phenomenon also suggested that the rapid changes brought about by the epidemic have given rise to transitional forms of education, such as Emergency Distance Learning (ERT), which are significantly different in nature from regular online teaching and learning (Godhe, 2024). Thus, some scholars caution that we should be cautious about interpreting teachers' digital leadership behaviors during a pandemic; it may not be representative in the long term. However, it is foreseeable that the future shape of education will move more towards a blended model of teaching and learning, especially in higher education. Teachers' digital leadership will also move from ad hoc adaptation to systemic construction and assume more ongoing guidance and support functions. Relevant studies pointed out that the standards of higher education quality are being reshaped in the post epidemic era, and some universities have already turned to delivery mechanisms that normalize online teaching (Arar et al., 2025). To cope with this transition, teachers' leadership skills, technological literacy, and cultural adaptability need to be strengthened.

B) Teachers' digital leadership practices and impacts in the education system

The practice of teachers' digital leadership was initially characterized by their mastery and application of instructional technology. However, with the rapid development of online teaching, blended teaching and AI-assisted teaching, the role of the teacher is gradually changing from a single “technology user” to an “innovation promoter”, “team collaborator” and even “agent of educational change”. This shift is not only reflected in the teaching and learning scenarios, but also extends to deeper changes in the culture and organizational structure of the school. Antonopoulou et al., (2025) pointed out that teachers with transformational leadership traits are effective in stimulating a collaborative culture, especially in building the digital ecosystem of the school. Teachers' leadership behaviors in

digital environments are gradually breaking through the individual level and becoming involved in reshaping organizational processes and guiding learning cultures. Chang et al., (2022) further confirms that in higher education institutions, teachers have taken on practical and critical leadership roles in the digitalization of curricula, decision-making on technology choices, and peer support, and that their ability to adapt and collaborate quickly became an important part of organizational resilience, especially in crisis situations. Collaborative skills became an important support for organizational resilience.

Jameson et al., (2022) suggested that teachers' digital leadership should include three key dimensions: Tech Skills, Pedagogical Integration, and Institutional Navigation. However, most of the current research still focuses on the level of "Tech Skills", and seldom explores the actual leadership behaviors of teachers in curriculum restructuring, organizational adaptation, and cultural guidance.

In this regard, Ghamrawi and Tamim, (2023) proposed the 5D leadership model in their empirical study, in which the "Digital Advocacy" dimension emphasized the role of teachers in promoting technological and cultural communication, and motivating organizational members to participate in digital leadership. In the digital transformation of education systems, the role of teachers goes far beyond classroom teaching. They are increasingly involved in teamwork, faculty culture building, and technology diffusion, demonstrating leadership in daily practice rather than relying on positional authority Lozano-Díaz et al., (2024). This "leadership in practice" is becoming the focus of new research.

The concept of digital culture is gradually entering the educational discourse. In many cases of school reform, teachers are not only seen as practitioners of technology integration, but also as important agents of organizational cultural renewal and values reshaping. This cultural dimension of leadership has long-term implications for the adaptability and sustainability of educational institutions. This is further illustrated by the "digital agility" model proposed by Srivastava et al. (2023). They emphasized that for teachers to lead in a changing digital environment, they must have the ability to adapt quickly, coordinate across departments, and continuously improve. It is not enough to be technically competent; truly effective organizational change requires teachers to be able to proactively facilitate cultural conversations, promote team sharing, and break down barriers to collaboration within the system.

However, this process does not always move forward smoothly. Fernández et al. (2024) note that teachers often face structural barriers from within their organizations when attempting to lead digital change. Their study showed that inadequate institutional support, rigid organizational structures, and resistance to new cultures are important constraints to sustained leadership among college faculty. The study emphasized that only through building a digital culture based on trust, collaboration, and sharing could teachers' digital leadership behaviors truly "permeate" all levels of the organization. From a more specific pedagogical practice perspective, Luo and Wang (2024) visualized the link between teachers' digital leadership and organizational innovation as "culture-led behaviors in curriculum construction". They suggested that teachers are not only curriculum implementers, but also "reconstructors" of the teaching culture, guiding students and colleagues to adapt to new digital learning environments by adjusting teaching processes and information structures.

Chang et al. (2022) also pointed out from the perspective of crisis management that, in the absence of stable institutional and policy guarantees, teachers not only mitigate the impact of the external environment by demonstrating strong adaptive and guiding abilities, but also activated the internal culture of the organization's "self-adaptive mechanism", which provides a key guarantee for organizational resilience. The practice of teachers' digital leadership has gone beyond the adaptation of technological tools, and has gradually shifted to deep leadership behaviors centered on value leadership, organizational synergy and cultural reconstruction. Current research has fully revealed the role of teachers in digital culture construction and organizational transformation, but the relevant literature is mostly based on case studies, and systematic theoretical frameworks and operational quantitative assessment tools are still scarce.

Therefore, future research can further focus on the dynamic interaction between "teachers' culture construction behaviors" and "organizational learning mechanisms", and promote the research on teachers' digital leadership to expand in the direction of the integration of organizational theory and educational change theory.

C) Barriers and support mechanisms in teachers' digital leadership development pathways

Despite the potential for teachers to become digital leaders, the reality is that they face multiple barriers to development, including: insufficient professional development support, differences in technological infrastructure, unclear leadership empowerment, and a lack of personal digital confidence. Neyisci and Sari (2023) noted that while teachers' digital engagement increased significantly during the epidemic, their leadership behaviors were still not systematically identified or formally integrated into the organizational structure of the school. Jameson et al. (2022) further noted that the current education system still perceived teacher leaders in a narrow way at the institutional level, often positioning them as those who are managed rather than the backbone with the ability to make autonomous change, which to some extent hinders the release of their leadership potential.

Researchers have generally focused on how teachers can effectively integrate technology tools (e.g., AI, LMS platforms) into instructional design and assessment practices (Maheshwari et al., 2024; Saraih et al., 2022), which is regarded as a core manifestation of digital leadership. As the strategy of informatization of education continues to advance, teachers' ability to deeply integrate technology with teaching and learning has become one of the core competencies for realizing the transformation of digital education. This competency not only requires teachers to have basic technical skills, but also emphasizes their comprehensive literacy in integrating technology with curriculum content, teaching strategies, and learning objectives. Pambudi et al. (2024) also pointed out that the key driver for teachers in technology integration is not only technology availability, but also teachers' intrinsic identification with the meaning of their teaching-i.e., the "sense of meaning in their work" as a mediating variable that significantly affects the depth of technology integration.

In addition, Hoang (2025), based on a study of EFL teachers in Vietnam, emphasized that "e-leadership development" in the context of AI integration requires teachers to flexibly deploy technological resources in teaching and learning scenarios, and to implement personalized and contextualized pedagogical reconstruction, while Luo & Wang (2024) proposed a model

of “Innovative Teacher Leadership” from the perspective of curriculum construction, which incorporates the leading role of teachers in an intelligent teaching management system. Srivastava et al. (2023) further introduced the concept of “digital agility” as a bridge between technological competence and pedagogical practice, stating that the higher the agility, the more teachers are able to proactively adapt to fast-changing digital tools and embed them into the teaching and learning process. Meanwhile, Chang et al. (2022) showed that in non-routine situations such as epidemic crises, teachers' ability to rapidly transform technology into effective teaching programs is directly related to the resilience of the education system and the sustainability of teaching and learning.

In summary, teachers' ability to integrate technology into instruction has evolved from a singular technical skill into a multidimensional framework that encompasses contextual awareness, pedagogical reconstruction, system adaptation, and reflective improvement. However, most current research continues to concentrate on the technical-operational level, while the development of structural models and evaluative tools to assess the depth of integration remains limited. Future studies should shift greater attention toward the underlying mechanisms and strategic impacts of technology integration within instructional contexts.

RQ3: What theoretical models are currently being used to explain teachers' leadership behaviors during digital transformation?

Although “digital leadership” was initially used to describe the ability of top school administrators to align strategic planning with technology use, the evolving role of teachers has led to growing recognition of Teacher Digital Leadership (TDL) as a critical driver of organizational transformation. At the theoretical level, researchers have begun to construct structured models aimed at systematically capturing teachers' leadership behaviors and their roles in digital pedagogy and cultural change. In the context of accelerating digital transformation, digital leadership has become a key engine of organizational change in education, healthcare, business and other fields. Currently, theoretical exploration and model development around digital leadership have gradually coalesced into a multidimensional and cross-disciplinary research framework. Scholars have conducted in-depth discussions from the perspectives of concept definition, capability modeling, theoretical framework and empirical model.

On the theoretical front, studies have widely adopted the TAM (Technology Acceptance Model), TPACK framework, and e-leadership theory to explain teacher behavior (Karakose et al., 2023; Jameson et al., 2022), with a number of studies attempting to integrate multiple models to increase explanatory power (Maheshwari et al., 2024). Among them, the Technology Acceptance Model (TAM) has been widely used to explain the willingness and behavioral mechanisms of teachers' adoption of new technologies, emphasizing the mediating role of “perceived usefulness” and “perceived ease of use” in decision-making (Hoang, 2025). In current research, the Digital Agility model has been widely used to analyze the leadership characteristics of teachers in dynamic technological environments. Srivastava et al. (2023) state that the model encompasses the ability of teachers to rapidly adopt new technologies, their guiding roles in organizations and the ability to reconfigure at the level of coping strategies, providing a theoretical basis for understanding how teachers can play a systemic leadership role in the context of digital transformation.

At the pedagogical level, although not often cited directly, the TPACK model, with its “technology-pedagogy-subject matter knowledge” integration perspective, has provided an implicit framework for teachers' instructional design and integration of technology in a number of studies. It emphasizes how teachers effectively embed digital tools into course content and instructional strategies, and is an important support for understanding leadership behaviors at the hands-on level.

The e-Leadership theory, on the other hand, focuses more on teachers' leadership behaviors in digital platform environments, especially their leadership characteristics in remote collaboration, cultural construction, and crisis response. The theory has been widely used in epidemic-related studies, providing a set of systematic paths to understanding (Chang et al., 2022; Fernández et al., 2024).

Meanwhile, some scholars have attempted to construct a more operational model of teacher leadership from a structural perspective. Karakose et al. (2022) proposed a model that covers the dimensions of strategic planning, technical competence, organizational coordination, and cultural adaptability, which provides a theoretical basis for identifying and cultivating teachers' digital leadership. The model emphasizes that teachers' leadership is not limited to technology, but extends to pedagogical innovation, institutional adaptation, and value guidance. The study further proposes an analytical framework based on “leadership behavior-organizational culture-educational practice” to reveal the potential leadership of teachers in multiple roles.

In addition, Antonopoulou et al. (2025) proposed an empirical model based on “motivation-participation-collaboration-innovation” with elementary school teachers as the core, combining the transformational leadership theory and technology adoption framework. The model follows a core pathway of “motivation–engagement–collaboration–innovation” and was used to explain the influence of teacher digital leadership on instructional satisfaction and perceived organizational support. In the field of higher education, Ghamrawi and Tamim (2023) developed the Five Dimensions of Digital Leadership Model (5D Model), which provides a structured tool for the multidimensional evaluation of teacher leadership. The model consists of five dimensions: Digital Literacy, Digital Culture Shaping, Digital Governance, Digital Differentiation, and Digital Advocacy, which emphasize the importance of teacher leadership. Advocacy, in particular, underscores teachers' capacity to provide holistic guidance across technical, cultural, and institutional domains.

In summary, although recent studies have proposed a range of theoretical models across different levels, the field continues to face challenges in model integration and lacks sufficient cross-theoretical dialogue. Future research could further explore the integration of multiple frameworks and enhance empirical validation. However, in terms of application, the Iqbal et al. (2025) suggested that the core qualities of digital educational leaders (DEL) in health professions education (HPE) focus on three main types of attributes, which are social attributes, strategic attributes, and personal attributes. The Digifue HR 2.0 scale developed by Claassen et al. was used for the assessment of digital leadership, but the scale was initially used for German municipal staff, but has since been further empirically validated in the education sector (Ören & Atik, 2025). The DigifueHR 2.0 scale evaluates two core dimensions of digital leadership: principals' support for educational innovation and their self-

organizational capacities. In the context of health professions education (HPE), Bajwa et al. (2024) developed the Digital Education Leader Competency Model, which outlines key competencies for digital leaders, including technology adoption, collaborative facilitation, ethical reasoning, and cultural sensitivity. This model further affirms the relevance of e-leadership in interdisciplinary and cross-sectoral educational contexts.

In conclusion, Jameson et al. (2022) observed that despite the growing volume of digital leadership research in higher education, theoretical development remains weak. They point to a lack of unified definitions, fragmented conceptual foundations, and inconsistent research quality. To address these issues, they proposed the Maturity Framework for Digital Leadership Research, which calls for future studies to clearly articulate theoretical dimensions, organizational contexts, and practical implementation mechanisms. Among the existing models, e-leadership theory remains the most mature and empirically validated framework to date.

Conclusions and research perspectives

Conclusions

By systematically sorting out and analyzing the research on digital leadership of college teachers in the field of higher education in recent years, this paper summarizes the following core conclusions:

First, the focus of research on faculty digital leadership has gradually shifted from pure technology application to multidimensional development of pedagogical integration, strategic leadership and organizational culture construction (Hoang, 2025; Lozano-Díaz et al. 2024). This shift not only reflects the changing role of teachers, but also highlights the complexity of the educational ecosystem in the digital context.

Second, although the definition of digital leadership varies across studies, there is a general consensus on its core competency structure across the four dimensions of technology, instruction, strategy and culture (Tan et al., 2024; Xu et al., 2025; Indra et al., 2022). Researchers are also increasingly inclined to use integrative theoretical models (e.g., TAM + TPACK + e-Leadership) to explain teachers' leadership behaviors and developmental paths. Based on these theoretical and empirical results, this paper constructs a systematic and contextually adaptive digital leadership framework for teachers. The framework combines individual competencies with external contextual factors, emphasizes the interplay between technology leadership and educational strategy, organizational culture, and pedagogical transformation, and provides a theoretical foundation and analytical tool for future research and practice.

Research Perspectives

As digital technologies become more embedded in educational practice, understanding how teachers lead through this change is increasingly important. Future research on digital leadership will be vital to supporting educators in this evolving role. Hoang (2025) explored the path of e-leadership development of EFL teachers in the process of AI integration in the context of Vietnam, combining with the Technology Acceptance Model (TAM) to emphasize the influence of cultural factors on the shaping of teachers' digital leadership competencies. teachers' digital leadership skills, while Pambudi et al. (2024) point out the mediating role of teachers' "sense of meaning" in their technology integration behaviors from a psychological

perspective. In the context of the epidemic, AlAjmi, 2022) and Chang et al. (2022) analyzed how teachers' e-leadership ensures the continuity and effectiveness of teaching and learning in distance learning environments from the Middle East and Asia regions, respectively. In addition, Xu et al. (2025) and Iqbal et al. (2025) extended their research perspectives to multicultural and digital citizenship education dimensions, emphasizing the linkages between principal leadership, teacher professionalism, and digital citizenship.

Although existing studies have explored the development path of teachers' digital leadership from multiple dimensions, there are still several obvious shortcomings overall. First, the research subjects are mainly cases or small samples, lacking empirical data for large-scale, cross-cultural comparisons; second, most of the studies are mainly descriptive in nature, lacking the integration and validation between theoretical models, resulting in the logical relationship between the core dimensions of digital leadership (e.g., strategic guidance, organizational coordination, and cultural construction) is not yet clear; in addition, few studies systematically explore the differences and similarities of teachers' digital leadership in different educational In addition, few studies have systematically explored the similarities and differences of teachers' digital leadership in different stages of education. Therefore, future research should further expand the breadth of samples, strengthen cross-country comparisons, incorporate multidimensional theoretical models, promote cross-cultural and cross-stage comparative studies, and reconstruct the connotation and practice framework of teachers' digital leadership from a dynamic and systematic perspective.

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